THYROPLASTY TYPE I – APOLLO HOSPITAL EXPERIENCE, WITH A BRIEF REVIEW OF LITERATURE

T. Ramadass[1] Nithya Narayanan[2], Girish N. Kulkarni[3], Shanker Ganesh S. R.[4]

ABSTRACT : *Thyroplasty Type I in Phonosurgery is one of the techniques first practised by Prof. Isshiki, a pioneer in this field. The technique that we adopted is a little different from his technique, which is highlighted in a series of six cases, done at Apollo Hospitals, Chennai from December 1997 to April 2001. The postoperative results were quite good and the patients could phonate without any effort. Patients followed up for one year showed no deterioration in phonation and they are back in their profession. A brief review of literature is documented.*

Key Words : *Thyroplasty, Medialisation laryngoplasty, Vocal cord paralysis, Silastic implant*

INTRODUCTION

The car mechanics search for a fault in the machine by audition of the engine sound and by inspection and likewise the surgeon detects the fault in the larynx by audition of voice and confirms by inspection with laryngoscope (4). Phonosurgery can be defined as surgery primarily intended to improve the voice, encompasses a wide variety of surgeries, i.e., cordal injection, micro laryngeal surgery, laryngeal frame work surgery, neuromuscular surgery, laryngeal reconstruction after laryngectomy and even prospective laryngeal transplantation. However, we are mainly dealing with laryngeal framework surgery or Thyroplasty, coined by Prof. Isshiki.

In an effort to create a more precise and descriptive list of definitions and terms, the Phonosurgery Committee of the European Laryngological Society has developed a new terminology for laryngeal framework surgery (3). Thyroplasty is classified into four types:

- Approximation laryngoplasty – Medialisation thyroplasty, arytenoid adduction.
- Expansion laryngoplasty – Lateralization thyroplasty, vocal fold adduction.
- Relaxation laryngoplasty – Shortening thyroplasty.
- Tensioning laryngoplasty – Cricothyroid approximation, elongation thyroplasty.

The proposed terms are functionally oriented and related closely to the intended purpose of the procedure. In this article we mainly discuss Medialization thyroplasty which is included in Approximation laryngoplasty.

The indications for this surgery are:

- Unilateral vocal cord paralysis with dysphonia
- Vocal cord atrophy with or without sulcus vocalis
- Vocal fold defects or localised glottal chink
- Displaced arytenoid cartilage causing glottal chink

In 1916 Payr reported the first Medialization procedure. He used anteriorly based cartilage flap. In 1952 Meurman used vertical parasagittal incision in the anterior thyroid cartilage and implanted an ellipsoid autologous rib cartilage between the alar cartilage and inner thyroid perichondrium. In 1955 Opheim – placed a piece of thyroid cartilage medial to the inner thyroid perichondrium within the substance of vocalis muscle (7). In 1968 Swashima et al – harvested cartilage from contralateral superior thyroid ala and inserted it in a sub perichondrial pocket through a vertical anterior parasagittal incision. In 1975 Isshiki achieved medialization by displacing and stabilizing a rectangular cartilaginous window at the level of vocal cords using thyroid cartilage (7). In 1980, he reported the successful use of an alloplastic implant material (Silastic) for medialization (5). The advantage of this material is that it can be custom -tailored for each patient. At present, Prof. Isshiki uses Gore-Tex, a new material which is easy to handle, soft and pliable, and can give gradual compression that is necessary (6).The

Fig I : Surface marking for the vocal cord on the thyroid laminae

[1]Professor and Head, [2] Registrar, [3]Registrar, [4] Senior Resident, Department of ENT, Apollo Hospitals, Chennai

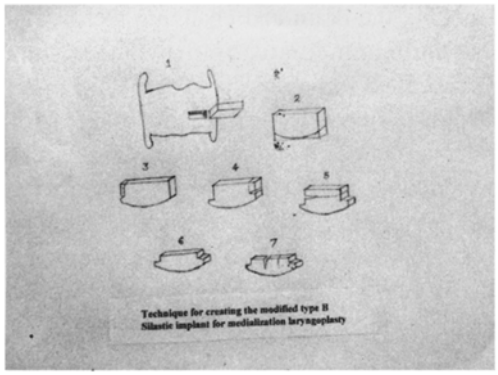

Fig II : Technique for creating the Koufman's modified type B silastic implant.

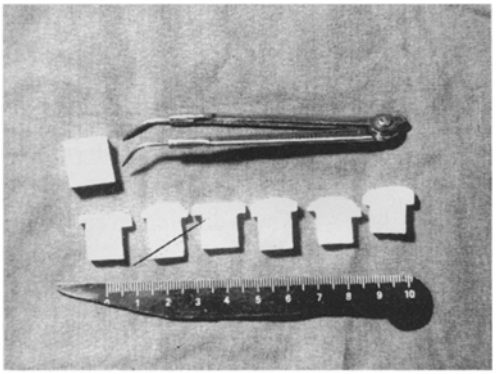

Fig III : Different sizes of prefabricated modified type B silastic prosthesis made from silastic block.

medialization with this, can be controlled by folding the strip, with an emphasis on posterior medialization. But the material is expensive and not easily available in India and hence Silastic material is preferred in our series. The Montgomery thyroplasty implant, offers an attractive alternative method for treating unilateral vocal fold immobility. In 1986 Koufman derived a formula for calculating the appropriate size of the laryngoplasty window, with gender variation (4). We have used this formula in all our cases.

MATERIALS AND METHODS

From December 1997 to April 2001, six patients with Unilateral vocal cord palsy due to different aetiologies were taken up for medialization laryngoplasty under local anaesthesia. All the patients came to our clinic for hoarseness of varying duration. They underwent routine clinical examination and evaluation by flexible fibreoptic laryngoscopy and manual compression test to know the improvement in voice quality. The pre-operative voice was recorded and the laryngoscopy findings were video recorded. Two patients presented with right vocal cord palsy following thyroid surgery. One patient presented with left vocal cord palsy following cardiac surgery. Two patients had left vocal cord palsy following road traffic accident and blunt injury to the neck. One patient had left vocal cord palsy of sudden onset after fever. He had taken a course of anti-tubercular treatment seven years back for pulmonary tuberculosis. His X-ray chest revealed fibrosis of left apical lobe, which might have caused the left cord palsy. The other two patients had idiopathic left cord palsy.

The computerized tomographic scan of the chest and neck were normal. They were taken up for surgery, six months after they were first seen.

Surgical Technique

The patients are premedicated with Inj.Pethidine and Inj. Atropine, 45 minutes before surgery. Topical 4% Lignocaine spray is used in the oral cavity and oropharynx. Local infiltration is given using Inj. 2% Lignocaine with 1 in 2,00,000 dilution in the neck, along with intravenous sedation. Patients are placed in supine position, with neck extended and head slightly turned to normal side. Draping is done and operating microscope with 300mm objective lens is used for the procedure. The thyroid notch and the lower margin of the thyroid cartilage are identified. In women, the thyroid cartilage may lie unexpectedly high. A horizontal incision is marked from the midline, few mm below the thyroid notch on the paralyzed side parallel to the lower margin of the thyroid cartilage, up to anterior border of stenomastoid. The incision is extended on the contralateral side by 1cm, usually in the skin crease. There is brisk bleeding from anterior jugular vein, which is ligated. The strap muscles are retracted or cut if necessary. The thyroid cartilage is exposed adequately. Midpoint between the thyroid notch and lower margin of the thyroid cartilage is marked on the exposed cartilage using measuring calipers. A needle is introduced at this point so that it enters the rima glottis at the anterior commisure, which is checked through laryngoscope to know the level of vocal cords. Then a horizontal line is marked on the thyroid ala, from the midpoint parallel to the lower margin of thyroid cartilage, upto the posterior border. This line is supposed to correspond to the upper surface of the vocal cords (Fig I).

A rectangular window is made 5mm lateral to the midpoint of thyroid cartilage, to avoid injury to the anterior end of vocal cords. The height and width of the window is calculated using Koufman formula, as the size of cartilage is larger in males and smaller in females (3). We use

measuring caliper for accurate drafting of the window size, which is critical.

$$\text{Window height (mm)} = \frac{\text{Thyroid alar height (mm)} - 4}{4}$$

$$\text{Window width (mm)} = \frac{\text{Thyroid alar width (mm)} - 4}{2}$$

The size of cartilage window is different according to gender :

For males - The window is usually 5-6mm in height and 12-15mm in width.

For Females - It is usually 4-5mm in height and 10-12mm in width.

After marking the rectangular window with indelible ink, according to accurate measurements with caliphers, the cartilage within the boundaries is cut using 15-blade knife carefully, stopping short of the inner perichondrium. If the cartilage is ossified, diamond microburr is used. The cartilage is thin anteriorly and thick posteriorly. The window cartilage is removed enblock or in piece meal keeping the inner perichondrium intact. Bipolar cautery is used to establish haemostasis at the margins of the window. The inner perichondrium is undermined posteriorly and inferiorly only, avoiding anterior and superior margins. Then a suitable size implant Koufman's modified Type B (Fig II), is chosen appropriate for the size of the window. Before surgery, various sizes of implants (Fig III) are sculptured from the silastic block, which are autoclaved and kept ready. If necessary the implant is down sized and shaped by cutting with a knife to give maximum restoration of voice, which is also monitored and recorded through laryngoscope and voice is also recorded. Vertical cuts are given in the implant to facilitate insertion of implant and excess of silastic is shaved up to the level of thyroid cartilage. The implant is fixed to the thyroid cartilage by using 4-0 prolene to prevent displacement and migration, when maximum voice is restored. After strict haemostasis the strap muscles are repositioned and are approximated with 4-0 vicryl. Wound is closed in layers with a drain, which is kept for 48 hrs. Antibiotics and anti-inflammatory drugs are given for 5-7 days. Patient is advised voice rest and to avoid excessive neck movements for 10 days. Postoperative voice is recorded after 1 week, 3 weeks, and 3 months.

RESULTS

All the patients taken up for surgery were males (age group: 10-20:2, 30-40-:2, 50-60:2). The surgery was done under local anaesthesia. All patients were discharged the next day after removing the drain and changing the dressing. All patients had immediate improvement in voice. Postoperative flexible laryngoscopy was done in outpatient department and videorecorded. Patients were seen after 1 week for suture removal and then after 3 weeks, 3 months, 6 months and 1 year. All patients had good voice during the follow up period. There were no signs of extrusion of implant or airway obstruction. Our results are subject oriented. We haven't used stroboscopy and voice laboratory investigations, which are expensive and sophisticated and not easily available.

DISCUSSION

Thyroplasty Type I surgery has replaced the older methods of medialization surgery like teflon injection, fat injection, collagen injection, open surgery etc., for regaining the voice in unilateral vocal cord paralysis. There are a number of disadvantages with cordal injection of teflon, like overdosing may deteriorate the voice and sometimes cause airway obstruction, formation of granuloma and operative technique is very difficult. Teflon may migrate into nearby tissues, like cricothyroid membrane, thyroid gland and the procedure is irreversible (4). The greatest advantage of laryngeal framework surgery is that the surgical procedure is adjusted to obtain the best voice and in cases of failure, the procedure can be repeated.

The manual compression test is extremely useful in predicting the outcome of surgery. The thyroid alae are compressed medially at various sites, any change thereby induced in the voice and larynx can be thoroughly assessed (4). Sometimes the thyroid cartilage in older patients is calcified and compression is difficult. Various authors have described various types of implants for medialization surgery like Montgomery prosthesis, Tantalum wire, which are very expensive and difficult to procure in our country (9). So the best biocompatible prosthesis is the one, sculptured from the soft silastic block. The shape of the silastic block which I have adopted is Koufman's Type B with little modifications. The cartilage window is removed leaving behind the inner perichondrium, which is pushed with the silastic implant. Postoperatively oedema of vocal cord usually lasts for 2-3 weeks, during which time the voice will be rather rough (8). A good normal voice in this period may imply that some regression will occur as oedema subsides.

Causes of reversion of voice several months after medialization are :-

- Subsidence of vocal cord edema
- Contracture of scar tissue near inner perichondrium of thyroid cartilage
- Progressive atrophy of vocalis, thyroarytenoid muscle by denervation.

Complications of Medialization Laryngoplasty are dyspnoea, stridor, subcutaneous seroma and migration of implant (1,2). This has never occurred in our series, in a follow up of two years. The primary procedure was sufficient to restore the voice to a great extent. So far no patient has extruded the prosthesis. Those with unsatisfactory voice in the long run may need arytenoid adduction as a second stage (10). In our series, arytenoid adduction was not required in any of the patients.

CONCLUSION

In our series we have operated eight cases from 1997 to 2001, as per the techniques mentioned above, the patients have gained substantially good voice.

The indication in these cases were:

- Unilateral vocal cord paralysis after cardiac surgery : 1 case
- Idiopathic vocal cord paralysis : 2 cases
- Unilateral vocal cord paralysis after thyroid surgery : 2 cases
- Unilateral vocal cord paralysis after trauma : 2 cases
- Unilateral vocal cord paralysis after pulmonary tuberculosis : 1 case

They were followed up from 6 months to 2 years and have sustained normal voice, with no postoperative complication. No extrusion of the implant was noted, in a follow up of one year. We have followed the guidelines given by Prof. Isshiki, but with little modifications, by removing the window cartilage. Dr. Isshiki preserves the window cartilage, over which he applies the silastic implant, which is anchored to the window margin. The window cartilage is preserved by Isshiki, as the retention of the cartilage with its inner perichondrium retains attachment without migration and will facilitate better medialization with the silastic prosthesis. However, the long time result appears to be the same in our cases and there are no recognizable complications. Arytenoid adduction which is irreversible has not been done in our series, to obliterate the posterior chink. Possibly the lower phlange of the silastic prosthesis is long enough to obliterate the chink. Medialization laryngoplasty with silastic implant is a very successful procedure with consistent results in adult population (8). It is usually done under local anaesthesia with sedation, to allow voice to be monitored during the procedure. The surgeon can then use a custom tailored implant or a specific prefabricated implant. Additionally, use of the flexible fibreoptic laryngoscope allows the surgeon to see the endolarynx during the procedure, thus avoiding over-medialization, which sometimes results in poor voice production. We have used Zeiss microscope during the procedure, mainly 300mm objective lens which facilitates precision surgery and have also video graphed the procedure with voice recording intraoperatively.

REFERENCES

1. Abraham MT, Gönen M, Kraus DH (2001) : Complications of Type I Thyroplasty and Arytenoid Adduction ; Laryngoscope, 111 (8) : 1322-9.
2. Cotter CS, Avidano MA, Crary MA et. al. (1995) : Laryngeal complications after Type I Thyroplasty:Otolaryngology – Head and Neck Surgery, 113(6) : 671-3.
3. Friedrich G, de Jong FI, Mahieu HF et. al. (2001 Oct): Laryngeal framework surgery – a proposal for classification and nomenclature by the Phonosurgery Committee of the European Laryngological Society, Eur Arch Otorhinolaryngol ; 258(8) : 389-96.
4. Isshiki N (1989) : Text of Phonosurgery, Theory and Practice, pp : 81-104
5. Isshiki N, Kojima H, Taira T, Shoji K (1989) : Recent modifications in Thyroplasty Type I : Ann Otol, Rhinol, Laryngol 98:777-779.
6. Issıki N, Mortin H, Okamura H, Hiramoto M(1974) : Thyroplasty as a new phonosurgical technique , Acta Otolaryngol 78 : 451-457.
7. James A. Koufman, Glenn Isaacon (1991) : Laryngoplastic Phonosurgery, The Otolaryngologic Clinics of North America, 24:1151-77.
8. Lundy DS, Casiano RR, Xue JW, Lu FL (2000) : Thyroplasty Type I – Short versus Long time Results : Otolaryngology – Head and Neck Surgery 122(4) : 533-6.
9. Mahieu HF, Schutte HK (1989) : New surgical techniques for voice improvement , Arch. Otorhinolaryngol , 246:397-402.
10. Phaniendra Kumar V, S. Ramachandra Reddy, M. H Das (1997): Medialization Laryngoplasty with Silastic implant in Unilateral Vocal cord paralysis, Indian Journal of Otolaryngology and Head and Neck Surgery, 99 : 3 : 262-264.

Address for correspondence
Prof. Dr. T. Ramadass
Head of Department of ENT, Apollo Hospitals,
21, Greams Lane Off Greams Road,
Chennai – 600 006, India